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Desiderata and Suggestions.

BY PROFESSOR CAYLEY, *Cambridge, England.*

No. 3.—THE NEWTON-FOURIER IMAGINARY PROBLEM.

THE Newtonian method as completed by Fourier, or say the Newton-Fourier method, for the solution of a numerical equation by successive approximations, relates to an equation $f(x) = 0$, with real coefficients, and to the determination of a certain real root thereof a by means of an assumed approximate real value ξ satisfying prescribed conditions: we then, from ξ, derive a nearer approximate value ξ_1 by the formula $\xi_1 = \xi - \frac{f(\xi)}{f'(\xi)}$; and thence, in like manner, $\xi_1, \xi_2, \xi_3, \ldots$ approximating more and more nearly to the required root a.

In connexion herewith, throwing aside the restrictions as to reality, we have what I call the Newton-Fourier Imaginary Problem, as follows.

Take $f(u)$, a given rational and integral function of u, with real or imaginary coefficients; ξ, a given real or imaginary value, and from this derive ξ_1 by the formula $\xi_1 = \xi - \frac{f(\xi)}{f'(\xi)}$, and thence $\xi_1, \xi_2, \xi_3, \ldots$ each from the preceding one by the like formula.

A given imaginary quantity $x + iy$ may be represented by a point the coordinates of which are (x, y): the roots of the equation are thus represented by given points $A, B, C \ldots$, and the values $\xi, \xi_1, \xi_2 \ldots$ by points $P, P_1, P_2, \ldots$ the first of which is assumed at pleasure, and the others each from the preceding one by the like given geometrical construction. The problem is to determine the regions of the plane, such that P being taken at pleasure anywhere within one region we arrive ultimately at the point A; anywhere within another region at the point B; and so for the several points representing the roots of the equation.

The solution is easy and elegant in the case of a quadric equation, but the next succeeding case of the cubic equation appears to present considerable difficulty.

CAMBRIDGE, *March 3d, 1879.*